

Beyond Eradication: Scientific Partnerships in Brazil and the Malaria Service of the Northeast

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Abstract

The study of mosquito-borne diseases, such as yellow fever and malaria, promoted an important international cooperation effort throughout the twentieth century. These activities are already well represented by a historiography dedicated to the so-called field of Rockefeller Foundation studies. Scholars have looked at the International Health Division of the Rockefeller Foundation (IHDRF) in Brazil as one of the great promoters of this cooperation, which was frequently involved with a series of complex negotiations, setbacks, and controversies. On the other hand, few studies have explored the development of cooperation between Brazilian and American scientists regarding fieldwork and continuity of research related to medical entomology and the study of microorganisms transmitted by mosquitoes. I intend to explore how scientific cooperation between Brazilians and Americans continued in light of the many challenges. They pursued their research objectives, even after the end of the cooperative eradication campaigns promoted by IHDRF, which had specific objectives, delimited by budgets and defined steps. Such is the case with the Cooperative Yellow Fever Service (CYFS) and the Malaria Service of the Northeast (MSNE). My research has benefitted from the reports, articles, and publications found in the collections of the Rockefeller Archive Center (RAC) and has resulted in historical reflections on fundamental aspects of cooperation between researchers involved in IHDRF projects and on the history of mosquito-borne diseases. The research carried out at RAC has contributed to my publication of articles and important updates in a recently published book, and has also outlined plans for future projects.

Beyond Eradication: Scientific Partnerships in Brazil and the Malaria Service of the Northeast¹

by Gabriel Lopes²

The aim of my research project “Vector-borne diseases, mosquitoes and scientific cooperation in Brazil - public health between the ‘local’ and the ‘global,’” is to understand how outbreaks of mosquito-borne diseases (mainly malaria and yellow fever) led to an important transnational scientific cooperation network. The intended historical approach is related to the field of the global health studies³ and to what Nancy Stepan has referred to as the “third wave” of Rockefeller Foundation studies⁴. In *Gênese da Saúde Global: a Fundação Rockefeller no Caribe e na America Latina*, Steven Palmer has provided a complex historical account of the interplay between the local actors and the staff of the International Health Division of the Rockefeller Foundation (IHDRF).⁵ Those contributions are important to inspire historical research regarding an understanding of the scientific relations and cooperation in public health and medical entomology concerning mosquitoes.

The cooperative work to eradicate the *Anopheles gambiae* mosquito (an efficient and dangerous vector of malaria) brought together researchers from Brazil (Instituto Oswaldo Cruz, Serviço de Estudo de Grandes Endemias) and American researchers of the IHDRF. The successful eradication work against *A. gambiae* in 1940 strengthened scientific research concerning vector-borne diseases and public health, as well as scientific cooperation between entomology experts. Also, cooperative work in the fight against the *Aedes aegypti* mosquito was important to understand the sylvan yellow fever cycle in the 1930s. My intention is to analyze and understand the efforts in the process of cooperative development of medical entomology.

It is important to stress that most of the studies on the work of the Rockefeller Foundation in Brazil regarding mosquito-borne illness center are about combating yellow fever and the work of the Cooperative Yellow Fever Service (CYFS). In many cases, the Malaria Service of the Northeast (MSNE) is described as a service within a more comprehensive narrative of the CYFS, as if it were a chapter describing the fight against mosquitoes within institutional efforts against yellow fever and its own principal vector, *Aedes aegypti*.⁶ This historiographic approach is justified, since (in administrative terms) the history of the MSNE is presented as a continuity of the CYFS.

My research at Rockefeller Archive Center was focused on the records of the International Health Division (a component of the records of the Rockefeller Foundation), record group 5, concerning the work of the Cooperative Yellow Fever Service (CYFS) and the Malaria Service of the Northeast (MSNE), including documents in Portuguese, such as the “Relatório do Serviço de Malária do Nordeste... 1939-1942.” Experts such as Raymond C. Shannon and Ottis R. Causey, who had rich lives of travels and had experienced intellectual and physical challenges in Brazil and elsewhere in South America, are well documented in the Foundation archives. The biographical files from record group 15 (1940-1980) include material concerning the lives of Causey and Shannon. These files were important to me as they provided a view of their activities as scientists, travelers, and scholars.

The Malaria Service of the Northeast (MSNE), created in 1939, replaced the Anti-Malaria Service (Serviço de Obras Contra Malária, SOCM), established in August 1938. The main difference between the two was that the MSNE was exclusively committed to exterminating the mosquito and gave full autonomy to the Rockefeller Foundation’s International Health Division, as the SOCM had no formal agreement with the Brazilian government or with the Foundation and was essentially a national service. The SOCM was created as an emergency response to a public health crisis. It faced difficulties prioritizing its activities in the states of Rio Grande do Norte and Ceará, and took different approaches in these two states. In Ceará, resources were directed towards palliative care for those affected by malaria, and in Rio Grande do Norte, research on *A. gambiae* was prioritized;

this resulted in the 1939 study by César Pinto titled “Disseminação da malária pela aviação; biologia do *Anopheles gambiae* e outros anofelinos do Brasil” (Pinto, 1939).

Fred Lowe Soper (1893-1977) played a major leadership role in eradication work against the *A. gambiae* in Brazil. Soper began his work at the Rockefeller Foundation in January 1920, after brief training in parasitology at Johns Hopkins University. Initially, Soper went to northeastern Brazil, conducting studies and organizing the Rockefeller Foundation’s campaigns against hookworm disease in the states of Pernambuco and Alagoas. In 1921, he was transferred to Rio Grande do Sul to monitor the campaigns against hookworm which were underway in that state. In 1922–1923, he returned to the US for a year of studies in order to obtain his master’s degree in public health from the Johns Hopkins School of Hygiene and Public Health. In 1927, Soper returned to Rio de Janeiro as lead administrator of the regional office, and later organized campaigns against yellow fever and malaria as head of the Cooperative Yellow Fever Service in 1930 and then as head of the Malaria Service of the Northeast 1939.

Particularly in the case of the *A. gambiae* eradication program, the scientific work of Raymond Corbett Shannon in cooperation with Brazilian scientists was essential. Before entering the International Health Division in December of 1927, Shannon taught entomology at George Washington University, where he also did some graduate study. Earlier on, in 1912, at 18 years of age, he began to work for the government as a student assistant in the office of entomologist Frederick Knab. In 1926-1928, Shannon was involved in studies in Argentina, specifically in Patagonia, first working for the Argentine government and later for the Rockefeller Foundation’s International Health Division. The arrival of the first African mosquito in the Americas, the *A. gambiae mosquito*, was recorded by Shannon in Natal, capital of the state of Rio Grande do Norte.⁷

Rio Grande do Norte’s problem with *A. gambiae* was initially considered to be a localized and regional issue, and thus did not have enough political force to compete with priorities related to health in Rio de Janeiro. This became clear in Fred Soper’s own assessment about prioritizing the cases of yellow fever in Rio

de Janeiro in the context of the CYFS.

Attention to the *A. gambiae* problem was initially lacking, and after a survey, Soper explained to the IHD director in a letter that Shannon's report was "optimistic and brings up the question of our responsibility regarding possible extinction of the species in Brazil." At the same time, Soper was aware of the transition period and political issues that were still underway in Brazil in that era, and that "the present state of disorganization in the National Health Service makes it extremely difficult for anything to be done through official channels" (Soper, 7 Jan. 1931, p.1).

According to a later MSNE report,⁸ the *A. gambiae* control timeline in Brazil encompassed the whole decade of the 1930s. It appeared, as follows:

1931 February - October - Yellow Fever Service and Rockefeller Foundation start first control campaign in Natal.

October 14 - Service turned over to Rio Grande do Norte State Health Department.

1932 During early part of year, R.G. do N. State Health Department in charge of control measures.

1932-38 From the latter part of 1932 to the early part of 1938, no effort to control *A. gambiae*. That led to the process described as the "Silent Spread" (Lopes, 2019)⁹

1938 April - The State Health Departments of Rio Grande do Norte and Ceará combat *A. gambiae*.

August 5 - Presidential decree allotting 1000 contos to Federal Malaria Service (Serviço de Obras Contra Malaria).

October 28 - The Serviço de Obras Contra Malaria of the Ministry of Education and Health begins campaign.

1939 January - President signs decree creating the Serviço de Malaria do Nordeste.

January 31 - Contract for a cooperative service signed by Ministry of Education and Health and Representative of the Rockefeller Foundation.

The objective of the MSNE was both the control and the study of the *A. gambiae* mosquito. The treatment of malaria cases was not prioritized, but was carried out on an emergency basis, in which the general policy was to reduce mortality ¹⁰

Although the extermination of the *A. gambiae* mosquito was the goal, several investigations were conducted on a diverse variety of mosquitoes, with both Brazilian and American specialists following a research agenda interested in general aspects of medical entomology. Much of the time focused on fieldwork, which consisted of understanding the habits of *A. gambiae* and capturing specimens and samples. Thus, contact with other mosquito species was inevitable, which favored cooperative parallel investigations.

The initial investigation about the *A. gambiae* was to discover what may be called “dry season permanent breeding sources.” In the initial investigations, Shannon realized that:

All that the farmers need to do to get water from their crops is to plow a ditch less and half a meter deep. The water then seeps into the ditches and develops a nice, gentle stream flow. Here and there where the water stands in quiet pockets *gambiae* is breeding in fair but not prolific numbers, probably not sufficient to maintain malaria in epidemic proportions (or hyperendemic). There must be a vast network of these ditches and I am sure it is one of the important dry season breeding places for the species in this region.¹¹

This understanding about the breeding habits and the pattern of the dry seasons pointed to the importance of using Paris green (copper acetoarsenite), a poison that could be used to kill the *A. gambiae* eggs and larvae. Also known as emerald green, imperial green, or moss green, it is odorless, easily sinks, and mixes slowly with water. This substance is poisonous if inhaled or ingested. This compound was originally used in the nineteenth century as a pigment but was later abandoned for this use because of its toxicity. For mosquito eradication purposes, Paris green could be mixed with kerosene and applied to areas where mosquitoes bred. ¹²

Field investigations were essential to observe the limits of expansion of the *Anopheles gambiae* mosquito in Brazil, especially in the interior of the states of Rio Grande do Norte and Ceará. The partnerships that contributed to the anti-

gambiae work organized by the MSNE were expanded to study other types of anopheles mosquitoes, without the direct purpose of extermination. The article, “Notes on the distribution and biology of Anopheles in the Northeast and Amazon regions of Brazil” is an exemplary case of a cooperation between Leônidas Deane, Maria Deane, and Ottis Causey, demonstrating the collaborative efforts to address other species.¹³

Overall, the cooperative scientific work intensified in the quest to eradicate the *A. gambiae*. In this excerpt of a letter, Soper pointed out the development of the activities in the laboratory and in the field:

Dr. Causey seems to be digging in very well on the laboratory problems at Aracaty; Dr. Hahn is being given an opportunity to get thoroughly familiar with the field organization and is learning Portuguese rapidly. Shannon has been three months in northeast Brazil and has returned more optimistic than even he was last year at this time. Shannon visited not only the infested area but the frontier zones and reports that he is truly surprised to find the region as clean as it is. My own impression of the situation and optimism for the future is not based entirely on the information furnished regarding the incidence of *gambiae* in the region but also on the great improvement now visible in the organization and its personnel.¹⁴

The research used the facilities of the MSNE laboratory, and initially had the objective of researching other mosquitoes in order to be able to compare them with *A. gambiae*. Even though Causey was directly involved in the project for the extermination of the African mosquito in the state of Ceará, this work gained momentum and expanded to the Amazon region, with activities continuing until 1944, four years after *A. gambiae* was eradicated. The researchers benefited from the organization of the MSNE to capture the species, especially because they had the support of many employees who collected larvae and mosquitoes for later identification. In conjunction with these efforts, Ottis Causey developed an important method of collecting and transporting adult anopheles and their eggs to facilitate their study.

Studies carried out in the Amazon and Northeast regions indicated the presence of 36 species of anopheles, however, only three species in this group (*A. gambiae*, *A. darlingi* and *A. aquasalis*) were mosquitoes relevant to the study of malaria

transmission. This more comprehensive research was only possible due to the organization and institutionalization of a service dedicated to the extermination of the *A. gambiae* mosquito. In this sense, even though the MSNE had the almost exclusive objective of eliminating *A. gambiae*, there were important advances in cooperation in medical entomology.

The mode of transport and accommodation of the samples occurred with the isolation of the females in small tubes with water. Spawning was used for analysis in the laboratory, which established a population of mosquitoes that could be studied from hatching to adulthood. Ottis Causey published about these new methods in 1943, under the title, “A Method for the Collection, Transportation and Study of Anopheline Eggs and Adults.”¹⁵

In order to understand how the *A. gambiae* mosquito from Dakar behaved in the Rio Grande do Norte and Ceará States, it was also necessary to have a better understanding of the behavior of this mosquito species through studies conducted in Africa, such as the work of English entomologist Ms. Alwen Evans, “Mosquitoes of the Ethiopian Region.”¹⁶ Her research was mentioned several times by Raymond Shannon, César Pinto, and Evandro Chagas. According to the MSNE report, it was a key to understanding the habits of the *A. gambiae* in Brazil.

In my research, I obtained important information about Raymond Shannon's career, including unpublished data about his investigations as a researcher on many subjects, such as insect ecology, with special application to malaria, yellow fever, and verruga peruana, and also about the research he conducted in Trinidad before his death. In addition, I was able to acquire more information about Shannon's death, in a probable suicide note: “Letters were found in the room, local newspapers reported, one addressed to ‘Tess’ and the other to ‘all concerned.’ The latter, it was reported said he blamed no one for his death, but that he was ‘too tired to go on asking nothing.’ He asked that he be buried in Trinidad.”¹⁷

Raymond Shannon was one of a number of historically underrepresented scientists who worked for the IHDRF. He, for example, had a rich account of his

scientific work in Brazil, and his biography of cooperative scientific work deserves more attention. Shannon had a very important role in the scientific cooperation with Brazilian scientists including César Pinto, author of “Disseminação da malária pela aviação...(1939)”.¹⁸ The information found at the RAC, was important to understand the fundamental role Shannon's collaborative research played in the medical entomology about mosquitoes in Brazil in the 1930s. It is fundamental to reaffirm the importance of these documents in shedding light on the assumptions that are associated with or conflict with institutional activities. Soper's political expression and his presence as a historical character seem to overshadow the research of scientists who had worked closely together and had monitored the surprising trajectory of *A. gambiae* when it was first discovered in Brazil.¹⁹

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² Casa de Oswaldo Cruz – FIOCRUZ. Rio de Janeiro, Brazil.

³ (Packard, 2016; Cueto, 2015)

⁴ Nancy Leys Stepan. *Eradication: Ridding the World of Diseases Forever?* London: Reaktion Books, 2011.

⁵ Steven Palmer. *Gênese da Saúde Global: a Fundação Rockefeller no Caribe e na América Latina*. Rio de Janeiro: Editora Fiocruz, 2015.

⁶ Ilana Löwy. *Vírus, mosquitos e modernidade: a febre amarela no Brasil entre ciência e política*. Rio de Janeiro: Editora Fiocruz, 2006.

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⁷ Raymond C. Shannon. “Brief History of *Anopheles gambiae* in Brazil.” *Caribbean Medical Journal*, vol.4, no.4, 1942, pp.1-7.

⁸ Relatório do Serviço de Malária do Nordeste do Ministério da Educação e Saúde 1939-1942. Folder 1.444, Box 113, RG 5 Series 3 (Rockefeller Foundation Records, RAC, Sleepy Hollow, NY).

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